The Air Line Pilot

Dec., 1952-Jan., 1953

Airborne Radar

ALPA Organization for Safety

E. A. Cutrell
—Page 7—

Sam Saint, ANTC Division, ATA, discusses the case

For and Against Airborne Radar

Airborne radar is both better and worse than most aviation people suspect. Cautious individuals throughout the industry are asking pointed questions concerning the potential advantages of airborne radar. Enthusiasts, and these are frequently individuals who would not have to pay the bill for installation and maintenance, are making claims beyond the real capabilities of present airborne radars. It seems an appropriate time to get some of the facts out on the table.

Interest in airborne radar is increasing. At least six major airlines are currently studying the possible use of airborne radar. These interested airlines have cooperated in the development of a set of operational requirements. A tentative equipment specification is now under preparation by the Airlines Electronic Equipment Committee. There are no less than five committees currently talking about airborne radar.

How Much Money? An airborne radar, to do an effective job, is certain to be more complicated and more expensive than most airborne electronic gadgets. It will cost at least as much as *all* of the communications and navigation electronic equipment now carried in scheduled airline aircraft. For this reason, it must be considered in the light of its relationship to other devices being considered in future planning. The big question is: When do you spend how much money to get what benefit? This is a decision that must be made by the operators concerned. Our wish here is to set forth the facts on which such a decision can be made.

Let me take off my Air Transport Association hat and talk to you as a pilot who has been in a position to learn what an airborne radar can do and what the engineers can add to make it better.

Together with Frank White, of A.T.A., I directed an airborne radar evaluation program that covered a period of two years. During the course of this program, approximately 2,000 hours were flown observing the performance of airborne radars installed in a DC-3, two DC-4s and a Convair. We studied every possible civil use of airborne radar. We navigated on ground beacons, flew in and around various types of weather, made low approaches on ground beacons, and spent many hours dodging mountains while flying under the hood. We have flown on solid instruments to within two miles of potential collision with a mountainside seen only on the radar. We made extensive flights at the scenes of six major terrain accidents.

Which Is Which. The course of this evaluation program led us to the conclusion that the primary function of airborne radar would be to dodge thunder storms and squall lines. More hours were spent in the air, a lot of it flying inside thunder storms, on this phase of the program than on any other. NACA engineers and recording equipment were used to document the findings. Thousands of photographs were taken of the radar scope. Special circuitry was developed to make the picture tell the pilot which was mountain and which was thunderstorm. Contour circuitry was added to let the pilot "see" which part of a given storm was worse.

Much thought was given to the possible use of airborne radar to cut down the hazard of air-to-air collision. The potential impact of airborne radar on the air traffic problem in congested areas has been studied.

The evaluation program outlined here was initiated by American Airlines and sponsorship was later transferred to the Navy. The complete document is available through Navy channels.

Investigation of airborne radar for weather avoidance is still going on. The Navy and NACA are jointly participating in flight tests in a B17G to determine the best wavelength for mapping and displaying dangerous weather and to further evaluate the "contour circuitry."

Technical Aspects. I do not want to get overly technical in this paper. For those who are interested, the documentation on this phase of airborne radar

About the Author

Sam Saint learned to fly in the spring of 1929, studied Mechanical Engineering at Drexel Institute in Philadelphia, joined American Airlines as a pilot in 1939. He has been successfully, co-pilot, captain, engineering test pilot, air traffic consultant to both Navy and Air Transport Command, manager of the Air Navigation and Traffic Control Development branch of American Airlines Engineering Department. Currently, he is Director of the Air Navigation Traffic Control Division of the Air Transport Association. He has maintained his status as an active airline pilot.

The Air Line Pilot

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W. Johnston, Editor

is quite extensive. A brief word of caution will suffice here. The business of bouncing radar pulses back from rocks and trees and river banks and displaying this information in picture form to a pilot is not simple. As you try to reduce equipment complexity, you are likely to find that its usefulness is being reduced faster than the weight and cost are being reduced. On the other hand, it is felt that the military radar (APS-42) may be somewhat more complicated than will be required to do a good job for transport category airplanes.

An airborne radar that will meet the specifications currently being written by the Airlines Electronic Equipment Committee should weigh approximately 140 pounds and cost approximately $20,000.

This radar will be a pilot-operated device with its scope or scopes mounted in the cockpit where both pilots can observe the picture conveniently. The scopes will be approximately 5 inches in diameter. Instead of the dim display of wartime airborne radar, it will have a brilliant display that will in itself create more acceptance for airborne radar than any one other feature of the airline airborne radar.

Fail Safe. Before discussing the various uses of airborne radar, let me point out an inherent characteristic that is important to all phases of the discussion. An airborne radar has one thing in common with the low-frequency radio range. You cannot use the signal or indication without, at the same time, evaluating the character or quality of the signal received. It will tell you the right story or no story at all.

This is an extremely important point where any new device is under consideration. A device that is completely trustworthy as far as quality of information will be used and appreciated by pilots even though it is unreliable at times. If, for example, a pilot finds that he can pick his way through a bad front without spilling the coffee when the radar is working, there can be little doubt that he will use it whether it is 100 per cent reliable or not. He will use it when it is working and complain loud and long when it is not.

Conversely, any electronic device that does not have this inherent fail safe characteristic must achieve something close to perfection in reliability before an airline pilot will trust it with the lives of his passengers.

Let's pause to confess here that the term "fail safe" has been badly overworked and sometimes distorted in its meaning. Nothing is ever completely foolproof. Eventually, you must trust something. We would like to build our gadgets in such a way that we trusted nothing but the law of gravity. Unfortunately, this is not possible. In the case of the airborne radar, a mistake can be made in reading the range marks on a scope. In the finer points of interpretation of a radar scope, it is possible for human error to creep in. On the primary uses, however, there is small possibility of error. A pilot is not likely to turn left when he meant

An "X" band radar (3 cm wavelength), the type now in general use, does not see the true shape of a heavy storm. The pilot might be drawn into the worst area. Answer: Use of a lower frequency that will penetrate the heavy rain.

to turn right if he is looking at a picture rather than at an assortment of needles and dials.

Pilots are taking thunderstorms more seriously these days. Higher speeds and higher altitudes have brought this problem closer to home. An airborne radar will map a "front" and show it to a pilot from 50 to 100 miles away. This is tremendously relaxing to a pilot flying a 50-ton airplane at 300 miles per hour on instruments at night.

A well-developed thunderstorm can be seen at much greater ranges than terrain echos. The technical people can tell you why. What we want to point out here is that there is little difficulty telling which is thunderstorm and which is terrain echo — *except where the storm lies among mountain peaks.*

Of course, where the rain is concentrated in relatively small areas, as it is in thunderstorms, you can usually dodge both the thunderstorms and the mountains. Note that this is not a problem where the cruising altitude is well above the mountain tops.

There is an answer, however. Frank White, in the course of the project, sparked the development of an antenna that could be switched from linear (horizontal) polarization to circular polarization. The pilot flips a switch. If the intensity of the radar echo drops sharply with circular polarization, it is only water. If the echo still looks the same, watch out! It has rocks in it.

This is a nice feature, but is expensive and adds to the complexity of the gear.

Another twist added to the radar by White is a simple bit of circuitry that lets you tell which part of the storm will have the worst turbulence. With the help of the NACA gust recording equipment, we discovered that the worst turbulence was *usually* found where the rainfall gradient was steepest —that is, where you go from no rain to heavy rain in the shortest space. This added trick we called "contour circuitry." It blanks out the portion of the storm where the echo is above a certain intensity and gives you a contour picture of the storm. If you have to go through the storm, stay away from that spot where the contour lines are close together.

This is not difficult or expensive, but it does add complication in an operational sense.

Dodging Ice. During the course of the project we conducted a service test of airborne radar. DC-4s assigned to the cargo run then operating between Seattle and Anchorage, Alaska, were equipped. This phase of the project confirmed our earlier findings, but it added an unexpected bit of gravy.

Pilots flying this run soon discovered

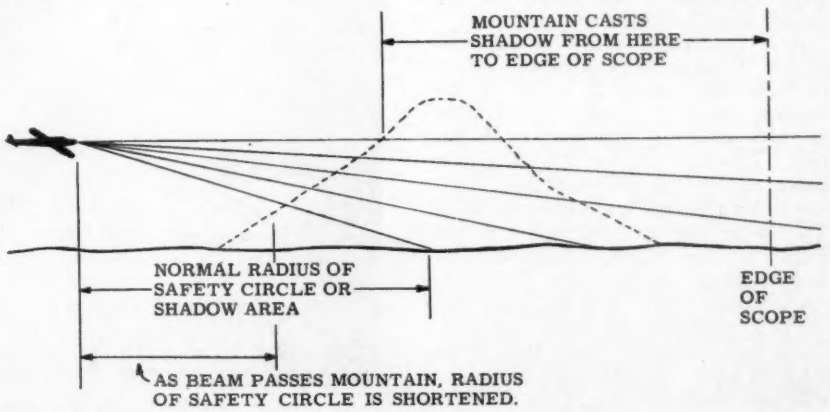
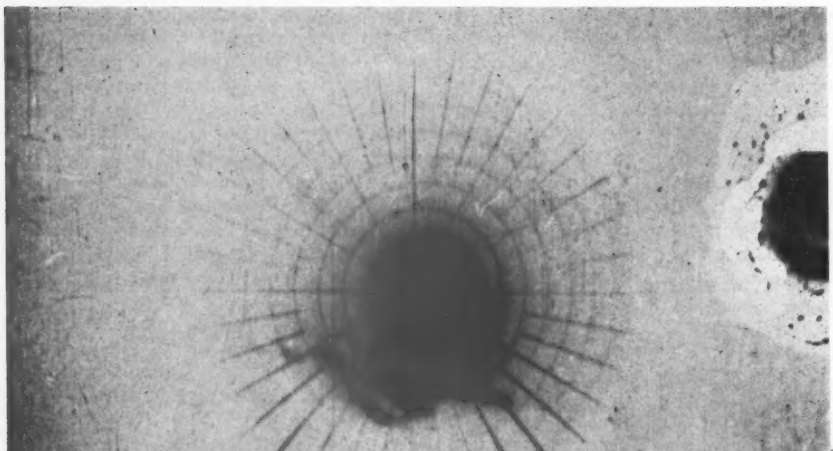

MOUNTAIN CASTS SHADOW FROM HERE TO EDGE OF SCOPE
NORMAL RADIUS OF SAFETY CIRCLE OR SHADOW AREA
EDGE OF SCOPE
AS BEAM PASSES MOUNTAIN, RADIUS OF SAFETY CIRCLE IS SHORTENED.

Fig. 1



Storm ten miles ahead. Gap between two parts of the storm is filling up because the radar is seeing the lighter rain areas at the shorter range.

that the super-cooled droplets in the air that cause certain severe icing conditions showed up very nicely on the radar. The combination of indications was simple. An outside temperature below freezing plus super-cooled droplets. Surprisingly, we learned that this type of icing condition was spotty and can be circumnavigated.

No True Weather Picture. When we say that existing airborne radars do not show the pilot the true weather picture, this will sound like a contradiction. An explanation is in order. The ability of the radar to penetrate weather is a function of frequency. The higher the frequency, the less penetration. Existing radars operate on what is called "X band" frequencies. This is a frequency having a wavelength of approximately 3 centimeters.

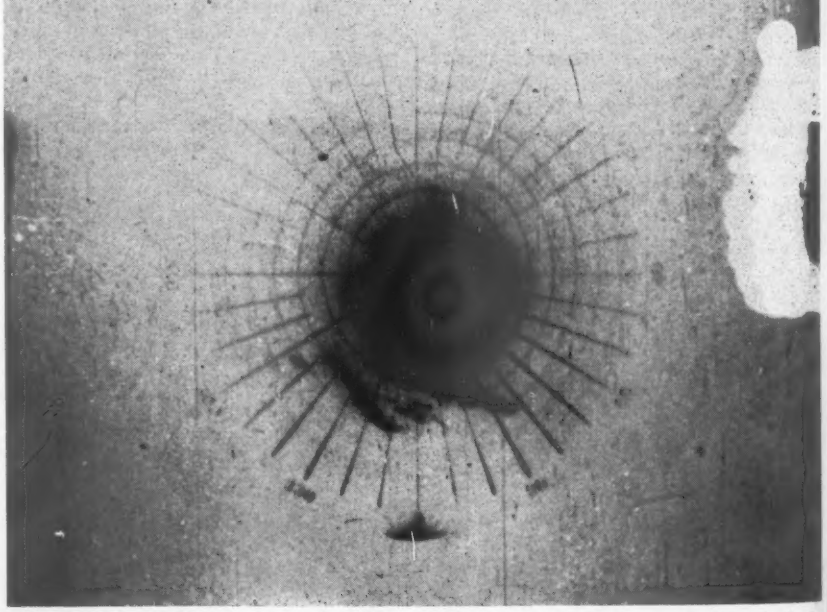
A 3 centimeter radar of approximately 40 kilowatts peak power can see through only about 2 miles of the heaviest rain. A picture is necessary to show the true significance of this fact. Take two storms. One is a mild storm, having only moderate rain. It is five miles through from front to back. The radar will see the true size and shape of this storm. Suppose now there appears on the same scope another storm. This is a big, fully developed thunderstorm with extremely heavy rain. It is 10 miles thick from front to back. In this case, the radar will penetrate this storm to a depth of about 2 miles. This means that the echo is only 2 miles through. *You will see from the illustration (Fig. 1, Pg. 3) how the pilot might very well be led into a bad situation by this misleading radar picture.*

We attach considerable importance to this problem in view of the fact that we think the primary use of airborne radar will be for weather detection and avoidance.

We are following, and participating, in an advisory capacity in a joint Navy/Air Force/NACA project—to determine what radar frequency will give optimum performance on weather. We think it is important that the pilot gets the true pitch.

The problem of weather versus frequency is further complicated by the question of beaconary. There is much question as to the use of airborne radar with ground beacons for navigational purposes. And some are suggesting the use of airborne radar, working in conjunction with beacons on other aircraft, to help solve the traffic congestion problem. These uses we will discuss in later paragraphs. The point here is this: Existing beacons work on "X band." If we are to use existing beacons, we must go to an "X band" frequency for airborne radar operation. If this frequency is not to be "X band," then a new development program is required for the necessary beacons.

In Case of a Mountain. Second in importance among the potential uses of airborne radar is its terrain warning characteristic. There is a sharp difference in the radar picture as a flight approaches a ridge just below or just above the top of the ridge. Furthermore, this warning is sufficiently arrestive when displayed in the cockpit at



Nearest Part of storm now twenty miles ahead. The radar antenna has been raised to eliminate ground clutter. The storm is forty miles long.

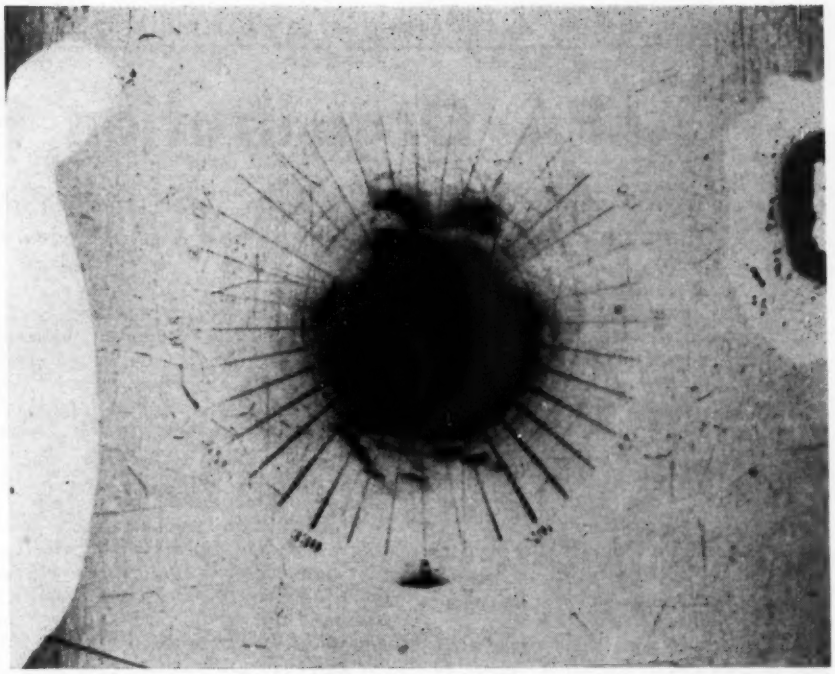
night (with presently available radar scopes) to insure that the pilot's attention is called, whether he is interested or not. Presently available scopes are not arrestive in daylight operation. The pliot would not be warned unless he was concerned about the proximity of dangerous terrain and was making a special effort to watch the radar picture. We are planning for the airline airborne radar to have an "arrestive" brilliant display in a brightly lighted cockpit!

The radar tells its terrain story in two ways. The initial indication comes from the fact that a ridge or mountain, approaching above the flight altiture, casts a radar shadow. The radar cannot see the terrain beyond the mountain; therefore, this portion of the scope will be black. As the ridge approaches, this shadow will move down across the scope like a black window shade. The initial indication, however, is only a warning of potential trouble. It does not tell the pilot whether he is safe or not at any given moment.

Positive knowledge of terrain clearance comes from what has been termed the "safety circle" in the center of the scope. From the accompanying sketch (Page 3), you will see that where a pencil beam type of scan is used, a shadow area is created in the center of the scope. You will realize that the radius of this shadow area is proportional to the height of the aircraft above the terrain. Analysis will show that the shape of this shadow area will tell the pilot which way to turn for greater terrain clearance. For example, an elongated portion of the safety circle will point down the valley. This is positive knowledge of terrain clearance. In practice, the pilot will become used to pushing this safety shadow area ahead of him as he flies. Anything that invades this safety circle will be of immediate concern. This "safety circle" technique loses its value below an altitude of approximately 1500 feet. This is true because the radius of the safety circle becomes too small to be of value.

An airborne radar has these advantages over other terrain warning devices. It gives advance warning—often from 20 to 30 miles in advance. It tells the pilot which way to run. The indication is a trustworthy indication; there can be no question as to whether the pilot will act on the indication. The radar does its job at the end of the line; that is, it does not matter *why* the airplane has gotten into a dangerous position. It simply says, heads up!

Careful evaluation at the scenes of six major mountain accidents and a study of the record on other terrain accidents leaves no doubt that airborne radar will cut the probability of running into mountains.



A line squall is seen at 40 miles, beyond the terrain clutter. The sharp shadow seen behind is the ridge at Leesburg, Virginia.

Here again, operational desirability runs head on into technical practicability. We would like to see the terrain in daylight as well as darkness. The question that operating people will have to answer is this: Do we buy it now without a daylight scope, or do we wait a year or two and develop a satisfactory daylight presentation?

Navigational Aid. In discussing airborne radar for navigation, let's consider first the basic radar without cooperating beacons on the ground. One of the first things you discover in using an airborne radar is that terrain, as seen by radar, cannot be matched to the map as you would navigate visually by towns and rivers and railroads. Navigation by radar mapping is extremely difficult except where there are outstanding land or water contours. If you are over Cape Cod or the finger lakes of New York, there will be little doubt as to your location. This sort of landmark, unfortunately, is not common.

On the other hand, a pilot flying a regular route will become familiar with the *radar land marks* along his route. In fact, most of the airline routes in the country will have enough characteristic radar landmarks to permit satisfactory radar navigation over the route. This may be a handy feature; it is thought to be of relatively small importance, however, because this type of navigational aid will disappear the moment the pilot gets off his familiar beaten track.

Use of the basic radar as a navigational aid will no doubt be more important to overseas operators who are forced to fly routes that are not equipped with enough conventional navigation aids.

Airborne radar can also be used in conjunction with radar beacons on the ground. These beacons answer a coded interrogation with a coded reply. This method of displaying this coded reply to the pilot is shown in the accompanying series of illustrations. (Page ....).

There are some appealing aspects to radar beacon navigation. The pilot is given a simple "picture" of his position and heading relative to the azimuth and distance of the one or more beacons that may be displayed on the scope.

We are convinced, on the other hand, that any attempt to foster radar beacon navigation will water down and confuse the navigational aids picture in general. Such confusion would almost inevitably result in less overall gain. We could not, for example, argue that radar and ground beacons could become a primary navigation system. The antenna problem in the airplane will forestall use of dual equipments. Furthermore, smaller aircraft

(Continued on Page 12)

Clarence N. Sayen, ALPA President, gives a close-up of

ALPA Organization For Safety

Addressing members of the Flight Safety Foundation at the Bermuda Safety Seminar, ALPA's President explained a pilot's views on air line safety.

The air line pilot is the primary consumer or user of the products, gadgets, procedures, or innovations that are designed to improve air safety in commercial air transportation. This explains one reason why he is concerned with safety and maintains an independent organization dedicated to the improvement of air safety. There are several other basic reasons.

One, the air line pilot has a primary responsibility for safety to his passengers, and the general public which cannot be delegated to anyone . . . neither his employer, the federal aviation agencies, nor any other person or agency. The air line pilot cannot, in good conscience, and in face of this responsibility, accept a product, gadget, procedure or innovation if he has any doubt as to its safety.

Two, the air line pilot has a natural interest in the development and growth of air transportation. Air transportation is his business. His own welfare depends on its prosperity. Since, for initial employment, an air line pilot is old at thirty, his professional career is determined with his initial employer when he reaches thirty. Unlike even the president of the company, he cannot readily transfer his knowledge and skill to another company; therefore, his "record" as a professional air line pilot is his stock in trade. He is not likely to look lightly at gadgets, innovations, or revised procedures that might fail him at a critical moment. He cannot in his primary responsibility to the public or to his professional career afford "experimentation" on the job.

Third, the professional air line pilot is interested in his own self preservation and economic gain, One of the greatest safety assets of commercial air transportation is the fact that most air line pilots are conservative family men.

Continuous Monitoring. Some air line pilot utilizes practically every commercial aviation facility in the world (outside of Russia) every day. In addition, practically every type of commercial aircraft, aircraft component, radio, commercial airport, etc. is utilized daily by a professional pilot. There is available, therefore, through this means a continuous monitoring of all aviation facilities. By the means of routine pilot reporting and special incident reports, the aviation industry has available its greatest source of information to determine that safety problems exist. *We conceive one of the primary safety functions of the air line pilot to be the discovery and reporting of air safety problems.* Anything that interrupts or interferes with the free flow of this information in itself constitutes a hazard. The ALPA then must perform several important functions to most efficiently render this service. One, a stimulus must be provided for continual alertness in the apprehension and reporting of hazards or incidents. The role of the critic must be maintained and must be attractive. Two,

Organization Chart ALPA Safety Pages 8-9

channels must be kept open and an independent spokesman provided through which reports may be properly channeled and effectively made known. Third, a medium must be provided for following up on reports to see that action is taken. The conscientious individual who never sees results from his work becomes frustrated and the work stops. He may cease to bother people with his complaints and the level of safety will drop accordingly. Complacency has never sponsored progress.

Incident Reporting. It is not easy to keep the channels open for incident reporting. Both officials of government agencies and air line officials have taken actions at times which almost completely shut off incident reporting on some air lines, and drastically reduced it throughout the industry. They, therefore, created a hazard of greater magnitude than that which they were at the moment trying to eliminate. Several examples will demonstrate this point. A day or two after the Bolivian P-38 rammed the Eastern Airlines DC-4 at Washington National Airport in 1949, an EAL Constellation took off from Washington National and began its climb-out in accordance with its air traffic clearance. The crew made a turn to the right and shortly after rolling out of the turn and while still climbing, an Army aircraft flying with the hood up, simulating an instrument approach, and in a steep rate of descent, flashed by the air line craft. The

(Continued on Page 13)

ALPA President, Clarence N. Sayen, attended the Flight Safety Conference in Bermuda during November. Shown above, are Arthur Jenks, Chief of the Flight Inspection Division, Office of Federal Airways; Herbert Fisher, Chief of Aviation Development, New York Port Authority; David Little, Assistant to American Airlines Flight Director; P. P. Cocquyt, Chief Pilot Sabena Airlines; V. A. Peterson and C. N. Sayen attending for ALPA.

Center-Line System: In Sight

After nearly seven years of controversy, ICAO's adoption of the ALPA-advocated Center-Line Approach Light System moves international standardization nearer.

Addressing the ALPA 12th Convention a few months ago, CAA Administrator Charles Horne said: ". . . I will agree to any kind of approach lights we can all agree to . . ."

Administrator Horne had put the problem neatly — Agreement. Since 1945, ALPA has had an approach light system which pilots agree is the answer to their needs. Why, then, delay in installing the system? There was not complete agreement among the other users. And, said CAA, we serve *all aviation*. In order to install the ALPA system, all users must agree that it is the one wanted.

Previous to the recent ICAO adoption, the system had been approved by the International Air Transport Association in May, 1952, and the International Federation of Air Line Pilots Associations at its Sydney Conference in April, 1952.

This month, in Montreal, the International Civil Aviation Organization said: "A world-wide standard for the construction of high-intensity approach lighting at international airports has been drafted by the Aerdromes, Air Routes and Ground Aids Division of ICAO . . . The new standard involves the use of a line of lights along the continuation of the center-line of the runway, with cross bars placed at intervals; from the appearance of this center-line and cross bars, the pilot can tell his position with reference to the runway and the attitude of his aircraft . . ."

ICAO officials called the step: ". . . the most important to improve air transport regularity since the adoption of standards for radio-navigation landing aids . . ."

Also Running. The center-line approach light system (Cut, this page) was not the only standard for landing aids set at the Montreal meeting. Following are additional important standards and recommended practices approved by the AGA Division of ICAO:

—Flashing lights incorporated as a part of the ALPA Approach Light System.

—Both approach and lead-in shall provide guidance for circling approaches.

—The approach light system shall produce no dazzle disconcerting to a pilot approaching land.

—The approach light system shall extend for 3,000 feet from the threshold.

—It is preferable that the rows of runway lights be as near as practicable to 150 feet between rows and not to exceed 230 feet.

—With runway lights on Instrument Runways it is preferable not to exceed a spacing of 100 feet longitudinally between lights.

—The intensity of runway lights should equal that of the inner 1,000 feet of approach lights.

—Adequate threshold lights are required. (ICAO referred to ALPA recommendations).

—Runway center-line markings shall be provided on all instrument runways. These shall consist of broken stripes not less than 3 feet wide. Stripes to be approximately 100 feet long spaced at approximately 100 foot intervals for the full length of the runway. Runway center-line markings are recommended for all runways, but the minimum width of 1 foot is permissable for other than instrument runways.

—Runway threshold markings shall be provided on all instrument runways for use in poor visibility and recommended for those other runways deemed necessary. These must be bold blocks not less than 100 feet long.

—Touchdown zone markings and side stripes are recommended practices with a note that side stripes might be limited to a standard width of 140 feet between the inner edges of the stripes.

The ICAO acceptance of the ALPA approach light system means that it

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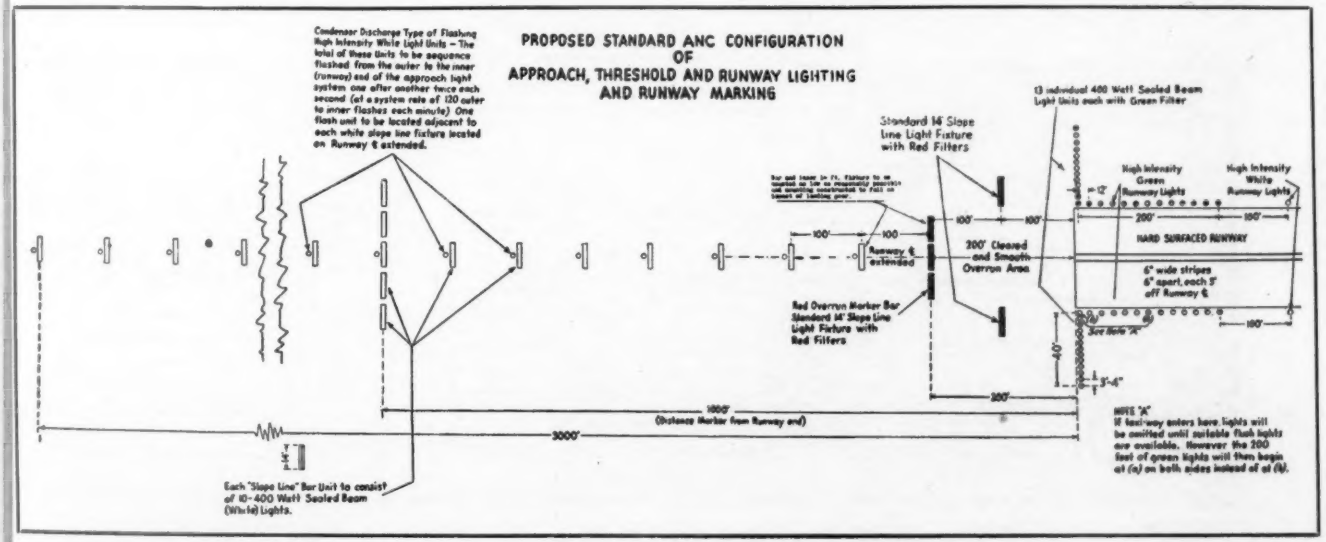
PROPOSED STANDARD ANC CONFIGURATION
OF
APPROACH, THRESHOLD AND RUNWAY LIGHTING
AND RUNWAY MARKING
Condenser Discharge Type of Flashing High Intensity White Light Units – The total of these units to be sequence flashed from the outer to the inner (runway) end of the approach light system one after another twice each second (at a system rate of 120 outer to inner flashes each minute) One flash unit to be located adjacent to each white slope line fixture located on Runway ℄ extended.
Standard 14° Slope Line Light Fixture with Red Filters
13 individual 400 Watt Sealed Beam Light Units each with Green Filter
High Intensity Green Runway Lights
High Intensity White Runway Lights
HARD SURFACED RUNWAY
200' Cleared and Smooth Overrun Area
Runway ℄ extended
Red Overrun Marker Bar Standard 14° Slope Line Light Fixture with Red Filters
6" wide stripes 6" apart, each 5' off Runway ℄
1000'
(Distance Marker from Runway end)
3000'
Each "Slope Line" Bar Unit to consist of 10-400 Watt Sealed Beam (White) Lights.
NOTE "A"
If taxi-way enters here, lights will be omitted until suitable flush lights are available. However the 200 feet of green lights will then begin at (a) on both sides instead of at (b).

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ENGINEERING & AIRWORTHINESS ADVISORY COMMITTEE

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5 H. MOUDEN - BNF

ALPA MEMBER NEW YORK REGIONAL AIRSPACE SUBCOMMITTEE
1 J.D. SMITH - CAP

ALPA MEMBER ATLANTA REGIONAL AIRSPACE SUBCOMMITTEE
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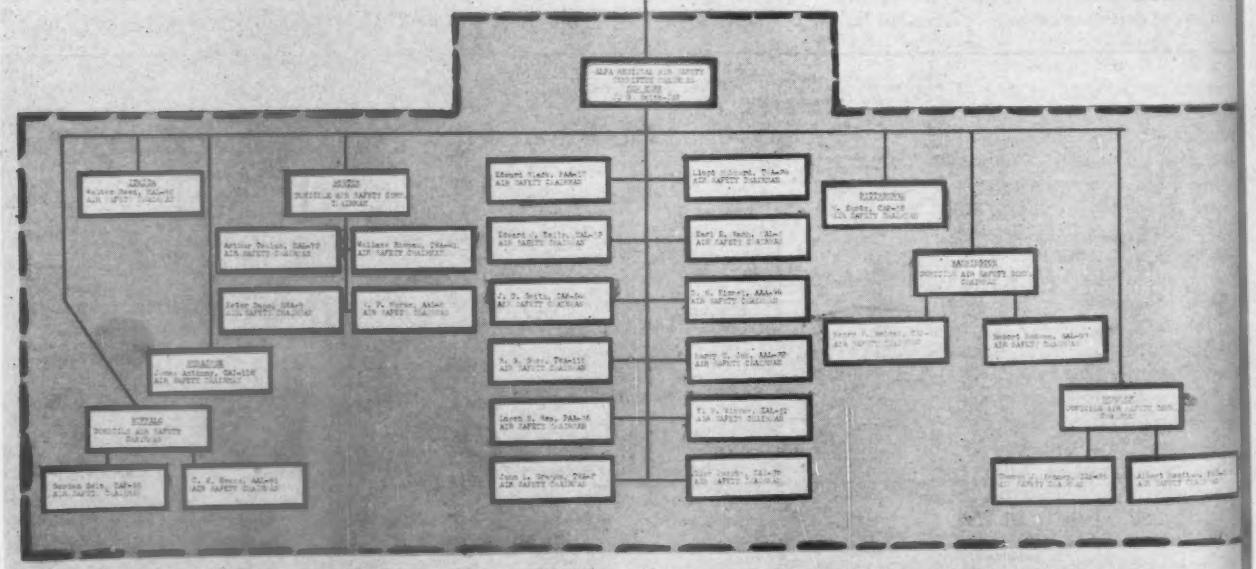

TYPICAL REGIONAL STRUCTURE

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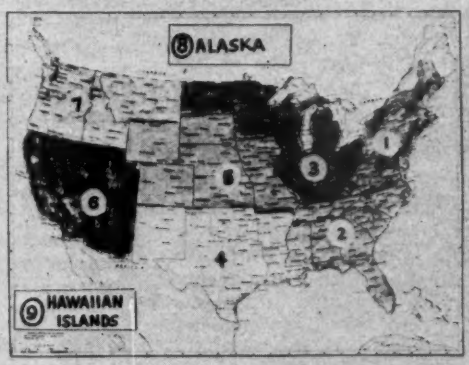

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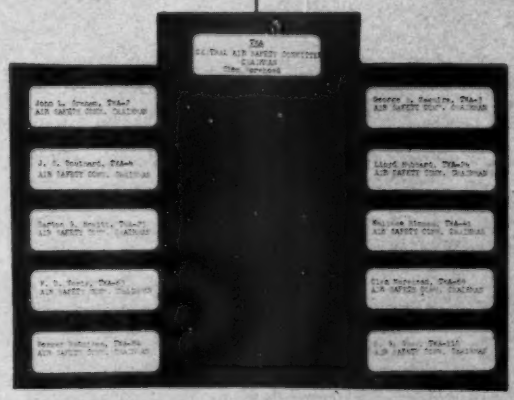
...TWA... CENTRAL AIR SAFETY COMMITTEE

OTHER AIRLINE CENTRAL AIR SAFETY COMMITTEES



TYPICAL CENTRAL AIR SAFETY COMMITTEE

News

Boeing Jet

The Boeing jet liner is expected to appear in mid-1954 with production scheduled before any competitor. Spare plant facilities were recently released for the early stage of parts fabrication which will lead to completion of full-scale mockups of vital sections necessary to lay out component and equipment location.

Design and performance reports will be withheld until the active sales campaign is staged. Management's theory is that prospective buyers will want to see the results of Boeing's jet experience before contracting with Douglas and Lockheed, and, immediate acceptance might be effected of the completed product is revealed at the time the earliest delivery date is promised.

CAB Procedural Changes

With the resignation of Chairman Donald Nyrop November 1, CAB control again fell to the whole Board with the following procedural changes being approved by staff executives and Board members:

—Executive hiring and firing down to division chief level is subject to the appeal of the Board. Previously, term "heads of major administrative units" included only executive director and heads of offices and bureaus.

—Board controls staff affairs on policy and major projects and delegates authority to executive director.

—Executive director of staff reports to the full Board once weekly to receive instructions and to report overall progress as well as more important actions taken by him. Director previously reported mainly to Chairman and served as Chairman's executive assistant.

—Office of Public Counsel will not be restored. Members apparently felt increased efficiency of the "bureau counsel" system outweighs the judicial advantages of a more independent "public counsel."

Board members are: Chairman Oswald Ryan, Republican Chan Gurney, Democrats Josh Lee and Joseph Adams. Eisenhower will probably appoint the fifth member the first of the year.

CAA Changes

CAA Office of Aviation Development has been abolished with the following adjustments:

—Joseph D. Blatt, assistant administrator, program coordination, will undertake future general aviation and aviation education programs.

—Wiley R. Wright, director of abolished office, will serve on Blatt's staff as director of general aviation.

—Technical engineering advice and assistance in development of aircraft and equipment will be rendered by the Office of Aviation Safety.

— Publication and distribution of literature and visual aids will be done by the Aviation Information Office.

New ALPA Executive Vice President

Sterling W. Camden, Jr., accepted the Executive Vice Presidency of ALPA December 23, 1952. The position has been vacant since July, 1951. Captain Camden begins his duties January 5, 1953.

Captain Camden, age 39, is married and has three children. He has been employed by Eastern Air Lines and is based in New York City. Camden soloed in 1930 and has been active in aviation since then. He has served the Association as Council Chairman, Chairman of the Master Executive Council, as member and chairman of negotiating committees and on various ALPA National Committees.

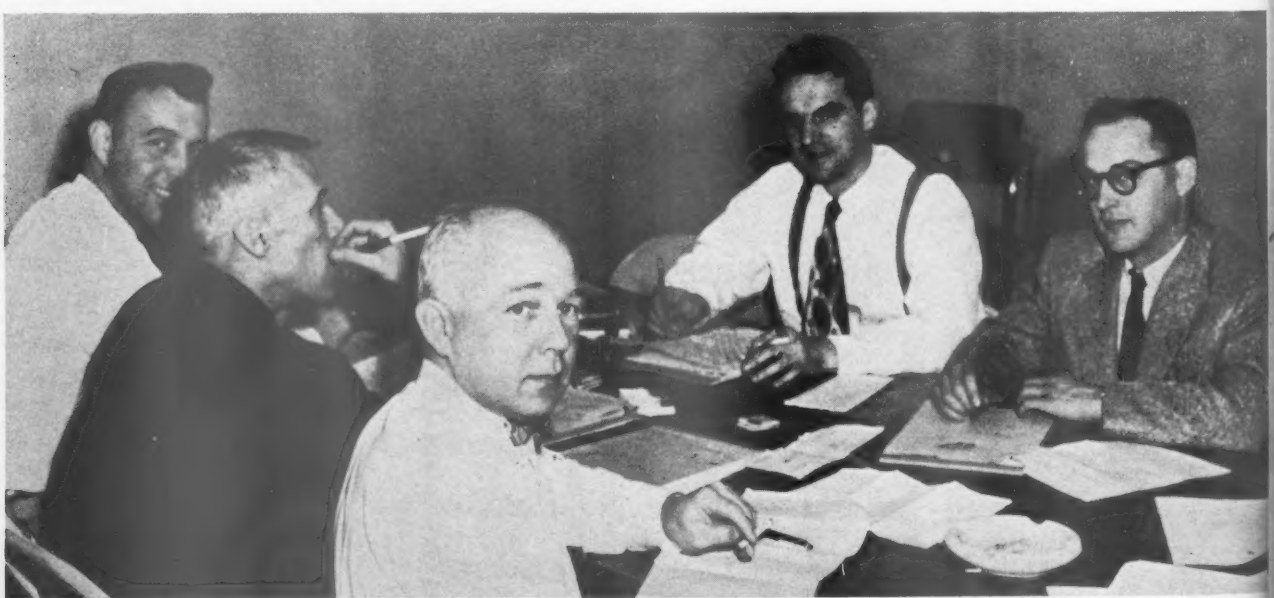
His administrative experience includes operation and management of fixed base operations, and supervision and general management of several large flight training schools. He also holds an A & E.

CAB Year-end Summary

The Civil Aeronautics Board has announced its year-end summary of scheduled and non-scheduled United States air carrier operations during 1952. Among 1952's achievements:

—The best safety record ever achieved by U. S. scheduled domestic air carriers. The new record indicated 0.38 passenger fatalities per 100 million passenger miles. This compares with a record of 1.1 set in 1950.

—A saving to the U. S. Government of more than 16 million dollars



The Mutual Aid Committee met several times during November to discuss Mutual Aid, Group Life Insurance, and Loss of License Insurance. Left to right are: R. W. Pontius, Ozark; Chairman Clyde Proper, AA; D. J. Smith, TWA; S. J. Devine, UAL; and W. W. Anderson, ALPA. Not shown are V. A. LeRoy, UAL; F. A. Spencer, AA; E. L. Zonne, NWA; and R. L. Oakman, ALPA.

achieved by the downward adjustment of mail rates for both domestic and international air carriers.

—An 83 per cent increase over 1951 in low-fare air coach travel.

Economic Progress. The Board discussed several economic phases of air line operations for 1952:

—Passenger miles, domestically and internationally, increased 17 per cent over 1951 and mail ton-miles and express and freight volume advanced 9 per cent. Due to the growth in coach traffic with its longer haul, the average passenger trip increased by about 7 per cent.

—The impetus to air travel from expansion of coach service is indicated by the 83 per cent growth in 1952 over 1951, in domestic and international travel. The volume of coach travel in 1951 equaled 15 per cent of first-class travel, while in 1952 it increased to equal 25 per cent of the volume of first-class travel.

—The year was notable due to merger negotiations. CAB approval was granted and arrangements concluded to consolidate Mid-Continent with Braniff; and Empire with West Coast. Mergers involving Chicago and Southern and Delta; Colonial and Eastern; and Colonial and National are under consideration.

Local Service. The temporary certificates of several local service airlines were extended for varying periods. Local service airlines accounted for a total of 336 million passenger miles during the year, an increase of 16 per cent over the previous year. This volume amounted to less than three per cent of total domestic passenger miles.

Safety. Passenger safety during operations of the U. S. scheduled air carriers was maintained at record level. These operations involved flying an estimated 24 million revenue passengers in the neighborhood of 12 billion passenger miles with only 46 passenger fatalities.

The volume of international operations was at a record high annual level in 1952 insofar as passenger and plane miles are concerned. However, the passenger fatality rate per 100 million passenger miles, is 3.1, the highest rate

In Honor of Walt

- On this page are photos marking a milestone in an air line pilot's career — retirement. Captain Walter J. Shaffer, Eastern Air Lines, retired to Atlanta, Georgia, this month, after 25 years and 4,300,000 miles of air flying. His record: He has never scratched a plane.
- Captain Shaffer learned to fly in 1915, flew with the LaFayette Flying Corps in World War I, the Air Forces in World War II.
- On his pension of approximately $200 per month, plus what he has saved, he plans to do naught but hunt and fish.
- Captain Shaffer is shown at right on his day of retirement and below with a group of his fellow Eastern pilots during the ceremony held in his honor.

since 1946, when it stood at 3.5. The rate for 1951 was 1.1.

Captain Blair

Capt. Charles F. Blair, PAA (ALP, Dec. 1951), has been appointed by the USAF to teach fighter pilots his simplified system of "packaged" celestial navigation. Blair was the first man to fly a single engine plane over the North Pole on a flight from Norway to Alaska.

The system will enable fighter pilots to check radio navigation aids in event of doubt or if they fail, and will permit mass fighter movements across regions of the world where radio navigation aids still do not exist.

Refueling in Flight

Aviation Week reports that aerial refueling of domestic commercial flights may occur within the next seven years coinciding with the estimated introduction of jet transports in the United States. Benefits were listed as:

—Reliability. Laboratory tests indicate there is no danger from fire as a result of static generation at the breakaway point between the tanker and receiver plane.

—Safety. It is believed that in addition to its major advantage of allowing a plane to take off with a minimum of fuel and a maximum of payload, it is much safer to refuel in mid-air than to come down, refuel, taxi and take off again. It is estimated that 60 per cent of accidents are due to situations involving the landing, taxiing and takeoff phases.

—Economic Aspect. Airlines will primarily consider the economics aspect. Mid-air refueling isn't likely to come into use domestically before the jet transports arrive because there isn't enough transcontinental traffic to support one-a-day, non-stop, coast-to-coast flights by the major arilines.

The introduction of jet transports, however, may produce enough traffic to warrant the non-stop flight because of the reduced time element involved in cross-country flights. Mid-continent refueling then would be warranted to allow takeoff with minimum of fuel as well as big payload.

Airborne Radar . . .

(Continued from Page 5)

could not readily carry this gear.

The military will have special requirements for beaconary, but it does not appear that civil users should complicate the airborne equipment with this added circuitry. We will talk more later about the use of radar working against beacons in other aircraft.

Seeing Other Traffic. Before saying, as we will, that airborne radar is of little value in seeing other traffic, let us hasten to say this: Our position on this question should not be construed as minimizing the importance of solving the air-to-air collision problem. We feel the need for better answers to the air-to-air collision problem as strongly as anyone in the industry. But we do not think airborne radar is the answer. Here is why we think this way.

Take the case for primary (unassisted) radar first. There is a great difference in the distance at which an airborne radar will see another aircraft. You may not see a jet with its sleek silhouette until it is within a half a mile. The four big fans on an airline transport may give a strong enough echo to be seen at eight or ten miles. The indication, when *it* is seen, is tiny and is not an arrestive indication, even at night.

Furthermore, primary radar alone will not see the other aircraft until it emerges from the ground clutter. This means that the radar equipped airplane will have to be high enough to have a large safety circle or shadow area in the center of the scope. An awkward complication is added by the fact that the radar will see the other traffic only in plan position. Altitude is not indicated.

All these things add up to a poor display of other aircraft. There is no doubt that the radar will give a small measure of aid in certain cases, but is far from being a suitable answer to the congested area traffic problem.

Some have suggested the use of beacons in other aircraft to let a pilot see his traffic at greater range and without regard to the ground clutter problem. This is technically difficult. We have had a firm requirement for an airborne beacon to work with ground radars for several years. All agencies are in agreement. In spite of this, we still do not have a satisfactory beacon for this purpose. Development of a beacon to work with a large number of airborne radars would be many times more difficult.

Radar and beacons could not become a *primary* aid in air-to-air collision prevention. There is no way to be sure that an airborne beacon indication will get through to the scope of someone else's radar. This means that airborne radar used in this way will provide only an incomplete double check at best. There is also the question of how you persuade operators of aircraft that are not equipped with airborne radar to carry a beacon that will respond to your radar.

Again it is impractical to display altitudes of other aircraft—even if you are willing to complicate the beacons to make them report altitudes.

Needed: Positive Answers. This is all negative. We need positive answers to the air-to-air collision problem. It is worth a minute or two to examine the operational requirements. Question: Could we operate in a congested area if all aircraft could see all other aircraft reliably? We think that considered opinion will decide that the answer is no. "See-and-be-seen" control as a basic principle breaks down when congestion reaches a critical level. It is not enough to know the present position of other aircraft. The intended future flight track must also be known. Control on a see-and-be-seen basis would degenerate to control by bluff and counter-bluff. We cannot operate this way with the airplanes we are now flying, especially when it is considered that, in full IFR operation, there will be from 30 to 50 airplanes within a 30-mile radius of the New York area with today's volume of traffic. On a smoky evening, when VFR flights are operating, there will be more.

Safe traffic control must be organized by a single authority on the ground. Most will agree on this point.

Perhaps we can agree, also, that at best the pilots' radar picture of the traffic would be a monitor of the situation. *This is extremely desirable.* But

Air Line Pilots Association Federal Credit Union Financial and Statistical Report Nov. 30, 1952

BALANCE SHEET

Assets

	November, 1952
Loans	$275,425.07
Cash	77,736.36
U. S. Bonds	268,651.58
Furniture and Fixtures	3,069.00
Prepaid Expense and Misc.	296.41
Total	$625,178.42

Liabilities

Shares	$594,562.25
Reserve for Bad Loans	8,824.71
Undivided Profits	4,421.91
Profit	17,204.78
Accounts Payable	164.77
Total	$625,178.42

STATEMENT OF INCOME & EXPENSE (Year to Date 1952)

Income

	November, 1952
Interest on Loans	$ 31,208.83
Investment Income	2,519.01
Other Income	69.89
Total	$ 33,797.73

Expenses

Salaries	$ 10,825.62
Office Expense	1,559.84
Educational Expense	36.29
Loan Insurance	1,898.91
ALPA Reimbursement	
Depreciation	643.51
Miscellaneous	1,628.78
Total	$ 16,592.95
Net Profit	$ 17,204.78

Statistical Information

Number of Members	2,123
Number of Potential Members	10,349
Loans made since Organization (Number)	1,955
Loans made since Organization (Amount)	$1,302,659.16

what is the pilot supposed to do or think when he sees the complex traffic interweaving in and out of an area like New York, where he does not know the altitude or the intended future flight track of any of the aircraft?

To summarize this phase of the airborne radar question, we think there is but little hope of any help at all. We have spoken out strongly on this point because we do not think airborne radar should be offered as a crutch to do something that it cannot do.

On the constructive side of the question, we feel that early implementation of the terminal area traffic control system outlined by Special Working Group No. 5 of the Navigation and Traffic Control Panel of the Air Coordinating Committee is the brightest hope on a confused horizon. (Copies of this Committee's report entitled *Air Traffic Control and The National Security* are available from the Government Printing office for sixty-five cents).

Some Difficult Questions. *Will the addition of airborne radar add to the Pilots' workload?* A controlled service test in normal day-to-day operation is needed to determine whether the increased workload involved in operating the radar controls and the time spent in observing the scope will affect the pilots' total operation adversely. We believe it will decrease the workload.

We need to know more on the question of: *How much skill is required to use an airborne radar properly?* It is our feeling that the basic use of the radar is so simple that a limited briefing only is required. There will be a large amount of additional information available to a skilled operator. Service test is again necessary to determine how much training is required.

Which factor should control equipment specifications: A better frequency or wavelength for weather mapping, or a less desirable frequency in order to use existing radar beacons? This is a difficult question. It is one that will have to be answered by the operators. The present industry position lies in the direction of a better frequency for weather detection.

Difficult compromises between operational desirability and technical complication are required on several points. Should the antenna be stabilized so the picture will not be lost when the aircraft is in a bank? Do you want to switch from horizontal polarization to circular polarization so you can tell whether a storm has a mountain top hidden inside? Do we need contour circuitry to let us pick the soft spots in storms we can't go around? Dollars in cost, complication in maintenance, and more controls to be-devil the pilot are here balanced against functions which may be considered vital, or may be considered as gilding the lily.

The most difficult question of all is this one. When you list airborne radar along with the several other desirable electronic devices, where does it come in the scheme of things? Do we persuade the stockholders to buy airborne radar after an airborne beacon (to work with ground radars) or before? Is airborne radar more immediately valuable than DME? Is it something we plan on using in our jet transports when they come along? Obviously, decisions on these questions must rest with the operators.

ALPA Safety . . .

pilot of the airliner executed a quick maneuver to avoid the Army aircraft whose crew apparently never saw the air line airplane. The captain of the airliner reported the incident to the tower pointing out the hazard and steps were taken to curtail military training flights in this congested area. The crew of the airliner heard nothing further regarding the incident for approximately six months when the captain and copilot received "greetings" from the enforcement division of the CAA informing them that the Administrator was seeking to have their pilot's licenses revoked. It seems that someone had computed that the air line aircraft may have been on a collision course under a rule book interpretation of the Civil Air Regulations. The crew spent many months in expensive litigation trying to clear their pilot records and to maintain their means of pursuing their profession. Incident reporting on the air line deteriorated.

Some few months ago an air line crew was ferrying an empty DC-6. The copilot had been having trouble with his landings and had a tendency to make high approaches. The captain, as is often expected of him, in addition to his other flying duties, was trying to train the copilot. The copilot, making the landing with the empty airplane repeated his error of a rather high approach. The pilot considered going around for another landing to give the copilot an additional opportunity; however, difficulty was experienced in reversing the propellers in landing and in bringing one of the propellers back to positive pitch. The go-around was therefore abandoned, the aircraft brought to a stop on the runway, taxied to the ramp, and on the propeller difficulty reported to maintenance. It should be noted that this incident occurred *after* the tragic National DC-6 accident at Newark where a propeller was found in reverse pitch and which accident increased the anxiety among flight crews over propeller difficulties. Upon maintenance reporting the propeller difficulty, the pilot was immediately removed from flight duty. Several days later he was discharged. He had been with the Company for more than 10 years and was regarded as a competent pilot. The reaction among the air line's pilots was so violent that all copilot training, including takeoffs and landings by copilots was suspended immediately by official action of the pilot group through their representatives, and serious consideration was given to suspending all incident reporting including log book notations, etc. Had this occurred the air line would have been paralyzed in a matter of days for lack of information concerning the state of aircraft and facilities. The pilot, many months later, is still involved in an expensive procedure trying to clear his professional record and be reinstated to his position. How far safety has been set back on this air line and progress curbed is incalculable. The ironic part of both of these incidents is that had the Eastern Airlines' pilot not reported the near collision he would never have been involved in extended litigation to retain his pilot's license, and the pilot reporting the reversing would still be employed had he but remained silent. They can only comfort themselves with the thought that one may have prevented further deaths from collision and the other a load of passengers from being killed by a reverse propeller in flight or a defective reversing on a wet or slippery runway.

Special Projects. Although we conceive the primary responsibility of the pilot to be the discovery and reporting of air safety problems, ALPA recognizes the necessity for the pilot or operational viewpoint being applied in the solution of problems. Therefore, in addition to the organizational processing of problems at the local, national, and international level which will be described later, ALPA attacks specific problems on a special project basis. This is accomplished by designating individual pilots with specialized training or experience along a particular line as spokesmen and specialists for the Association on a specific subject. Committees are set up to work with the spokesman. The committee and spokesmen have available to them the channels and facilities of ALPA from which to gather information or determine pilot opinion. By this means, pilot specialists sitting with industry committees

trying to find solutions to air safety problems are in a position to responsibly represent the operational or pilot viewpoint. They are also in a position to determine the "consumer acceptance" of the results.

ALPA currenty has 18 special projects in progress embracing such subjects as airport lighting, fire prevention, cockpit standardization and others.

Contract Writing. Safety considerations must permeate one other aspect of ALPA's activity—that of establishing the rates of compensation, rules and working conditions for pilots. Since ALPA is by law the collective bargaining agent for practically all of the air line pilots in the United States, ALPA with the air carriers largely determines the rules and working conditions of pilots. Extreme care and caution must be exercised that safety is a primary consideration in this activity. For this reason, among others, active line pilots participate and make the final decisions in all ALPA collective bargaining sessions.

Accident Investigation. ALPA participates in the investigation of all major air carrier accidents. Standard investigation and reporting procedures have been worked out and are furnished to pilot representatives. Reports of each investigation are made to the President of the Association. Such reports are analyzed by ALPA staff members and pilot representatives for clues that may prevent future accidents. Recently the practice of reporting the probable cause of the accident has been instituted. In this regard, it should be noted that ALPA readily admits that there are "pilot error" accidents. However, it holds that no pilot ever erred deliberately or in the interest of self-destruction. ALPA is interested in the *reason behind* the error and feels that any accident written off as "pilot error" has not been adequately investigated. For example, did the error originate in design error, fatigue limits, cockpit booby traps, inadequate training program, etc. ALPA feels that this viewpoint must be strongly represented at all accident investigations if the operational aspect is to be thoroughly explored and the maximum learned from each accident.

ALPA Organizational Structure

The basic unit of the ALPA organization is the local council. At each domicile where a minimum number of the pilots of a particular air line are based, a local council is organized. Each council has a Local Council Air Safety Committee which is charged with the processing of local air safety problems. This may include contacts with the local air line, government, civic, or airport officials. Surveys conducted by ALPA are processed through this Committee. There are currently 115 Air Safety Committees throughout the United States, Alaska, Hawaii, Puerto Rico, Great Birtain, Germany, Egypt, Peru, Brazil, and Japan.

Central Air Safety Committees. The pilots of one air line may have 10, 12 or more Councils. Representatives from each council comprise the Air Line Central Air Safety Committee. Problems common to more than one Council or concerning the entire air line are processed through this Committee. There are currently 41 Air Line Central Air Safety Committees.

Regional Air Safety Committees. Representatives from the Council Air Safety Committees in a particular region comprise the Regional Air Safety Committee. For example, representatives from 15 Air Safety Committees make up the New York Area Regional Air Safety Committee. This Committee processes problems which are peculiar to a particular geographical area. Example: The noise problem in the New York area.

Attend Your Council Meetings

National Air Safety Organization. The National Organization of ALPA maintains an Engineering and Air Safety Department through which problems from the 115 Council Air Safety Committees, 41 air lines, or regional committees may be processed. The national organization usually serves as the spokesman on national problems or designates a pilot specialist or pilot committee to speak for ALPA. A "draft release" procedure is employed to secure a representative opinion on a subject. Special committees are required to submit their findings for comment to all Council Committees. The industry representative who feels that he has gauged pilot opinion by the process of speaking to several pilots at random is naive . . . however, we still occasionally hear the statement "but I spoke with several pilots and they told me this is what the pilots want." If representative pilot opinion is desired, go through channels to the pilot representatives.

The 12th Convention of ALPA provided for an Annual Air Safety Forum. This will be an annual convention of safety representatives from each air line who will devote their meetings entirely to air safety problems.

International Federation of Air Line Pilots Associations—is a federation of pilots organizations from 20 different countries with international offices in London. The processing of safety problems of an international nature and representation at ICAO is effected for the member organizations through IFALPA. An annual meeting is held of representatives of the 20 member organizations. Special study groups are established to deal with individual problems. Study groups are maintained in each geographical area of the world to monitor facilities and represent pilot viewpoint on problems peculiar to the area and concerning which pilots flying continuously in the area will be best informed.

Safety vs Economics

ALPA represents pilots in their economic problems as well as their safety problems. We are familiar with the constant complaint of the safety specialist that the air line operator and government agencies too often get their economic and air safety thinking mixed and that safety suffers as a result. It is proper to inquire, therefore, whether ALPA opinions on safety matters are not sometimes dictated by economic considerations. This question may be answered in two ways. First, ALPA is a strong enough organization to process its economic problems without recourse to the utilization of safety as an argument. Safety decisions may be made without the consideration of utilizing such decisions toward achieving an economic goal. Secondly, however, we must be realistic enough to remain cognizant that unresolved economic problems influence safety and must, therefore, be considered. Unresolved problems influence morale. The air line industry is susceptible to "wars of nerves." Low morale adversely affects safety. We are cognizant of (1) the importance of exercising extreme caution in flight operations during periods of economic crisis or low morale, and (2) the advisability of seeking, as expeditiously as possible, solutions to problems which arise. If there must be a dispute over an issue, it is better to have it quickly and reach a decision.

Consumer Acceptance. Even a designer of clothespins would not put his commodity on the market without attempting to measure the "consumer acceptance" . . . and then when the commodity comes on the market, the

consumer has the prerogative of accepting or rejecting it. Yet, on occasion in the aviation business, we still have new gadgets, standards, and procedures placed into operation without pilot representatives ever having been consulted or informed. In a recent instance, the gross weight of an aircraft was altered without consultation with or information to the pilot representatives. This despite the fact that gross weight increases alter the performance pattern of the aircraft.

It is my belief that the user viewpoint should be represented throughout the conception, design, testing and adaptation of aircraft, their components, or operational procedures if the maximum of safety value and acceptance is to be achieved. The existence of an effective and responsible association of pilots, having facilities for the dissemination of information and an organizational structure capable of making available responsible spokesmen through whom government agencies and industry representatives may work, is of positive value to accomplish this goal. Through one agency, government and industry may sample the "user viewpoint." Opinions, viewpoints and decisions which are reliable may be secured.

The Air Line Pilot welcomes comment on its editorial content

One further point should be made clear on the ALPA viewpoint and organization for safety. We do not believe that a bi-lateral approach by the government and pilots, or management and pilots, to safety problems deprives the government official of his authority or the management official of his managerial prerogative. It is simply a more effective way of improving air safety —a responsibility the pilot cannot avoid or delegate nor the government or industry avoid or delegate.

Approach Lights . . .

now has received the approval of the majority of users. Previously backing the system have been the ALPA, IFALPA, ATA, IATA.

Why the Center-Line. Tests conducted by ALPA and other agencies have shown that the pilots' demand for the center-line system has not been without reason.

The major points in favor:

—The center line of the runway is readily identified by the long single row of lights.

—The bar-type light fixtures give the pilot both a horizon and level indication immediately.

—Positive threshold warning and threshold indication is given the pilots by a series of bars and colored red and green lights.

—Fog-piercing condenser lights, which emit flashes of light of short duration, point out the approach lights before the fixed lights become visible.

Said Aviation Week, as early as 1950: "Advantages of the center-line cross bar system are mainly its simplicity, and lack of optical pitfalls. Finding and following a center-line is obviously the simplest way to get on course and stay there during an approach for landing.

ALPA thought of money, also, when suggesting its system. The single-line system will stretch the approach light appropriation dollar further than any other system due to its greater economy of installation, operation, and maintenance.

Some proof:

—Only one trench is required to install and maintain the electric leads.

—A minimum amount of fixture mounting locations is required.

—A minimum number of lights is necessary.

—It requires a minimum of land condemnation or acquisition—an extremely important factor due to the great difficulty in condemning land, or obtaining easements adjacent to airport property.

—Trouble shooting and maintenance is kept to a minimum due to the lesser number of lights and mounting fixtures confined to a single row.

Past History. With the goal now in sight, the ALPA members who worked hardest for adoption of the single-line system as a standard can look back with pride upon their efforts.

1945 marked the system's year of birth when in December of that year Captain Ernie Cutrell demonstrated his landing aids arrangement to several ALPA members at LaGuardia. ALPA approved.

It took four years of working overtime for ALPA members to wring out an actual test for the system. In November, 1949, the CAA began conducting tests on the system at Arcata, California.

The next major step in the right direction came approximately two months later when the CAA announced that it was abandoning its current slope line system as the national standard. The CAA's statement came at a meeting in January, 1950, of the Army, Navy, Civil Subcommittee on Visual Aids to Air Navigation. This was but two days after a meeting of the government's Approach Light Evaluation Panel.

At the ALEP meeting, ALPA submitted its findings from a series of tests. The report included specifications and drawings of the single-line system, and operational reports compiled by ALPA members.

In announcing the CAA's abandonment of the slope line system, the Administrator said that studies had shown that terrain problems made the system impractical for at least half of the airports at which approach lights must be considered.

With the slope line out, ALPA's single line system was now given room to move into the vacant spot as the national standard. And slowly, the ALPA system began to inch its way into the vacancy. In October, 1950, CAA began installing the single line system at Newark Airport. In April, 1951, the installation was completed and pilots flying the eastern seaboard began testing the system in actual operations.

Determination. Prime battler for the single-line system has been ALPA's Ernie Cutrell. Captain Cutrell, an American Airlines pilot for over 15 years, was in on the beginning—the 1945 demonstration at LaGuardia—and attended the ICAO meeting in Montreal, pushing for the system, when it was established as a world standard. Between times, he has been tireless in his efforts to assure the system hearing before the world's aviation authorities.

Captain Cutrell has an honored history as a fighter for flight aids. During the year he demonstrated the single-line system, he received the Octave Chanute Award of the Institute of Aeronautical Sciences. The award is for "the year's most notable contribution by a pilot to the aeronautical sciences."

He was granted a military leave from American Airlines in 1942 to join the Headquarters Staff of the Air Transport Command in the special projects section. By 1944 he was commanding officer of the Navigation and Landing Aids Unit of ATC. He supervised all-weather flying tests on instrument landing systems installed over an experimental New England route.

In November, 1951, Captain Cutrell was honored by the Flight Safety Foundation for "distinguished work in the field of air safety."

Since his return to American Airlines in 1946, Captain Cutrell has led the fight for the single-line system. With conclusion of the battle in sight, he deserves great appreciation from his fellow pilots.

You Can't Do That!

That is what nearly everybody says on hearing about our wonderful and exclusive insured savings program, the President's Protective Investment Plan. They don't see how it is possible to pay the full face amount of the contract plus return of all premium deposits in event of death during the depositing period.

But, just as the 68 year old Franklin Life Insurance Company has pioneered in becoming the first company to provide unlimited and unrestricted life insurance coverage to airline flight personnel on a standard basis, so it has developed new, modern and flexible plans of coverage designed to fit today's insurance needs. And, over the past 12 years the Franklin insured savings plan has won tremendous public acceptance.

If you are interested in the most modern and attractive contract on the market today, we will be very happy to give you a full explanation.

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